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Research Article

A Systematic Review of Junior High School Mathematics Curriculum in Indonesia and Australia

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ABSTRACT

Purpose of the study: This study analyzes the comparative mathematics curricula between Indonesia and Australia to uncover various aspects of the education systems. The focus is on the similarities and differences between the curricula, systematically examining them in terms of objectives, materials, methods, and assessment, particularly in mathematics.

Methodology: This study used a library method with the main data sources coming from 58 articles, 44 books, and 10 official documents in a qualitative descriptive manner. The research data analysis used the Systematic Literature Review method through the following steps: identification, screening, eligibility, and inclusion based on keywords, titles, abstracts, inclusion and exclusion criteria, and referenced literature.

Main Findings: The mathematics curriculum in Indonesia and Australia at the Junior High School level is almost the same with a few differences, namely the focus on the profile of Pancasila students and providing more specific mathematical knowledge and skills to support the development numeracy and direct further fields of study in mathematics and other disciplines, so that it can add other aspects or components that researchers have never studied regarding the comparison of the mathematics curriculum in Indonesia and Australia.

Novelty/Originality of this study: This analytical study of the comparative study of the Indonesian and Australian mathematics curriculum was conducted by citing various sources, namely articles, journals, official curriculum websites, books, and proceedings articles, thus providing a broader study of further studies on the development of the mathematics curriculum in Indonesia and Australia globally.

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1. INTRODUCTION

One aspect that influences the success of national education is the curriculum. The curriculum is a component that plays a vital role in the education system [1], [2]. In the world of education, the curriculum is often referred to as the heart of education, so it can be said that the curriculum is a set of plans to achieve learning objectives which include objectives, content and learning materials [3]. This is also supported by the opinion that states that the curriculum has three main dimensions, namely, as a subject and as a learning experience [4], [5]. This is different from the opinion that states that the curriculum is all experiences that are systematically arranged by educational units [6], [7], so it can be concluded that aspects in the curriculum are always related to the design prepared by the educational unit to achieve learning objectives.

The curriculum has an important role in the learning process to optimize the achievement of goals, so that the curriculum has its own role according to the needs of the times [8]. This is also supported by the opinion that states that over time, the curriculum experiences development and change, so it is necessary to measure its success, whether it is better than before or not, so that the development and changes bring good results in the world of education [9], [10]. In addition, this fact is also supported by curriculum theory as a number of learning materials that are important to be taught in educational units [11]-[13] which has several components including objectives, materials, learning strategies, curriculum organization, and assessment so that the curriculum is created to achieve educational goals [14]. Apart from that, this is also in line with the objectives of the curriculum which have an important role in the educational process because the existence of objectives can direct all educational activities and other curriculum components [15] so it is necessary to develop learning strategies or methods which are components of the curriculum related to the arrangement of students in the learning process, as a tool to achieve educational goals, both as an educator, student, principal, and parent [16], [17]. In addition, the assessment component in the curriculum also needs to be taken into serious consideration in the curriculum development process of an educational unit because it is related to the method used to determine the achievement of a learning objective [14], [18].

Furthermore, this is further clarified by the history of curriculum development in Indonesia from 1947 to the present, starting with the lesson plan curriculum introduced in all schools after Indonesian independence. The curriculum underwent further changes in 1952 until finally in 1964, the government of the Republic of Indonesia made improvements, and then underwent further changes in 1968, which was based on Pancasila, special skills, and basic knowledge. The curriculum then underwent further changes in 1984, known as the CBSA (Active Student Learning Method) curriculum, which refers to mental activity, but still involves forms of student physical activity. Subsequently, a new curriculum emerged in 2004 known as the competency-based curriculum. It was developed in 2006 and 2008 into the KTSP curriculum, then further refined as the 2013 curriculum, and is currently changing and developing again into the independent curriculum. This fact is also related to the mathematics curriculum within the framework of the independent curriculum currently in effect in Indonesia, which provides freedom and comfort in learning without forcing students to master a science outside their field and takes into account the interests and talents of each student [19]. Mathematics is a crucial subject and plays a crucial role in achieving educational goals in Indonesia. Learning outcomes in the independent curriculum, particularly in mathematics, represent a renewal of the Core Competencies (KI) and Basic Competencies (KD) contained in the 2013 curriculum. Learning outcomes are measured based on student developmental stages, while KI and KD are measured annually according to the student's grade level [20], [21].

Mathematics is one of the subjects in the current curriculum, but there are still significant problems in its development, including the integration of 21st century learning approaches [22], [23]. This is supported by the fact that one of the problems with the current mathematics curriculum is that learning outcomes are not significantly high compared to the fact that Indonesian students study mathematics for 173 hours per year, but the results are not yet significant [24], [25]. In addition, the existing facts also confirm that the results of the mathematics scores in PISA in 2018, Indonesia was ranked 72nd out of 78 countries with a score of 379, in contrast to Australia which was ranked 29th out of 78 countries with a score of 491 [26], [27]. In addition, according to a global survey conducted by US News regarding countries with the best education systems in the world, Australia is ranked ninth as the country with the best education system in the world compared to Indonesia, which is still far behind in ranking compared to several other countries [28].

The above facts are also supported by the opinion that the mathematics curriculum in Australia prioritizes learning outcomes at each level [29]. This is also supported by the statement that the mathematics curriculum in Australia places more emphasis on the quality of infrastructure and the quality of education, including mathematical abilities, compared to Indonesia, which does not yet have a balance in learning outcomes between students and does not yet have a mindset and intellect within it [30], [31]. Based on this fact, in terms of the curriculum used, the curriculum in Indonesia uses the independent curriculum, while the curriculum in Australia uses the latest version of the curriculum, namely "Australian Curriculum Version 9.0.", so that based on the material there tends to be differences in terms of its elements [32], [33].

On the other hand, the mathematics curriculum in Australia is based on the Australian Curriculum, Assessment, and Reporting Authority (ACARA), which has a major role in developing the Australian curriculum [34]. The Australian mathematics curriculum is structured around three content areas and four skill areas. The content areas cover number and algebra, statistics and probability, and measurement and geometry. The skill areas cover understanding, fluency, problem-solving, and reasoning. Each skill area is integrated into the content area, with this approach emphasizing students' mathematical skills to develop their ability to think and act logically. The Australian mathematics curriculum emphasizes educators applying the skills and content areas that students must achieve using a broad mindset [35]. The material covered in the Australian mathematics curriculum is in the high level category in terms of core complex problems or application questions and uses high level words [36].

Furthermore, the mathematics content in the "Australian Curriculum Version 9.0 Mathematics" has six elements that align with students' learning needs. These six elements include number, algebra, measurement, geometric shapes, statistics, and probability. Furthermore, assessments in the Australian mathematics curriculum are conducted to measure students' knowledge and develop skills, particularly in numeracy and literacy, as a prerequisite for life [29], [37]. Furthermore, the Australian mathematics curriculum also includes three different assessments that will be taken in the national assessment to test learning outcomes. Therefore, based on several studies that have been conducted, there has been no research comparing curricula seen from other aspects, namely objectives, materials, methods, and assessment. However, researchers only took three aspects in this study: objectives, materials, and assessment because the curriculum data that has been found, especially in Australia, only includes objectives, structure (content elements), and assessment standards, so that it can help Indonesian education to optimize the educational process in Indonesia, especially in mathematics subjects. This is because comparative studies of curricula between countries are one way to understand various aspects related to the education systems in Indonesia and Australia, especially those related to the similarities and differences contained in the curriculum.

2. RESEARCH METHOD

This study uses a library method or what is commonly known as "Library Research" by taking various library information such as journals, articles, books, and documents. The type of data used in this study is descriptive qualitative data in the form of words in describing the differences between the two curricula by looking at the types of data obtained through systematic and clear descriptions. The objects in this study are data from the Indonesian mathematics curriculum and data from the Australian mathematics curriculum. The Indonesian curriculum uses data from the "Merdeka Belajar" curriculum focusing on mathematics subjects issued by the government through the official website of the Ministry of Education and Culture, namely https://www.kemdikbud.go.id/main/. The curriculum in Australia uses data from the "Australian Curriculum Version 9.0" focusing on mathematics subjects issued by the Australian Department of Education through the official website of the Australian government, namely https://v9.australiancurriculum.edu.au/ and several supporting data such as articles, books, and journals.

The procedure in this research will be carried out systematically so that data can be obtained optimally through the following stages: (1) finding out the required data. In the first stage, the researcher looks for data on the mathematics curriculum applicable in Indonesia and Australia; (2) selecting data sources to be used in the research; (3) identifying and analyzing mathematics curriculum data from Indonesia and Australia reviewed from the aspects of objectives, materials, and assessment; (4) comparing mathematics curricula from Indonesia and Australia covering aspects of objectives, materials, and assessment; (5) drawing conclusions from the research. Data sources are related to the materials that will be used as research material. In library research, there are two data sources, namely primary data sources and secondary data, namely: (1) Decree (SK) of the Education Standards, Curriculum, and Assessment Agency (BSKAP) Number 033/H/KR/2022; (2) Australian Curriculum Mathematics F-10 Version 9.0.

Data analysis in this study uses the Systematic Literature Review method through qualitative systematic review steps to answer research questions through four steps: identification, screening, eligibility, and inclusion (final selection of articles), thus helping to improve transparency, consistency, and completeness of reporting the results of systematic reviews and meta-analyses. Journals obtained from Sinta and Scopus using the keywords "Australian curriculum" AND "Indonesia curriculum" AND "mathematics learning" AND "primary school" OR "secondary school" through the search flow and the number of literature identified in the PRISMA framework are shown in Figure 1 below by referring to keyword searches and then selecting literature based on titles and abstracts, inclusion and exclusion criteria as shown in Table 1 below, as well as references from the referred literature.

Table 1. Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
• The literature used consists of academic-philosophical, theoretical, and practical studies on junior high school mathematics curricula in Indonesia and Australia. • The literature refers to publications in reputable journals or conference proceedings, books, and official documents.	• Literature published within the last 10 years. • Literature in the form of a website or blog. • Literature not in Indonesian or English. • Literature not related to

Inclusion Criteria	Exclusion Criteria
• The literature was published within the last 10 years in reputable journals indexed by Sinta and Scopus. • The literature was published in both Indonesian and English.	mathematics curriculum studies in Indonesia or Australia.

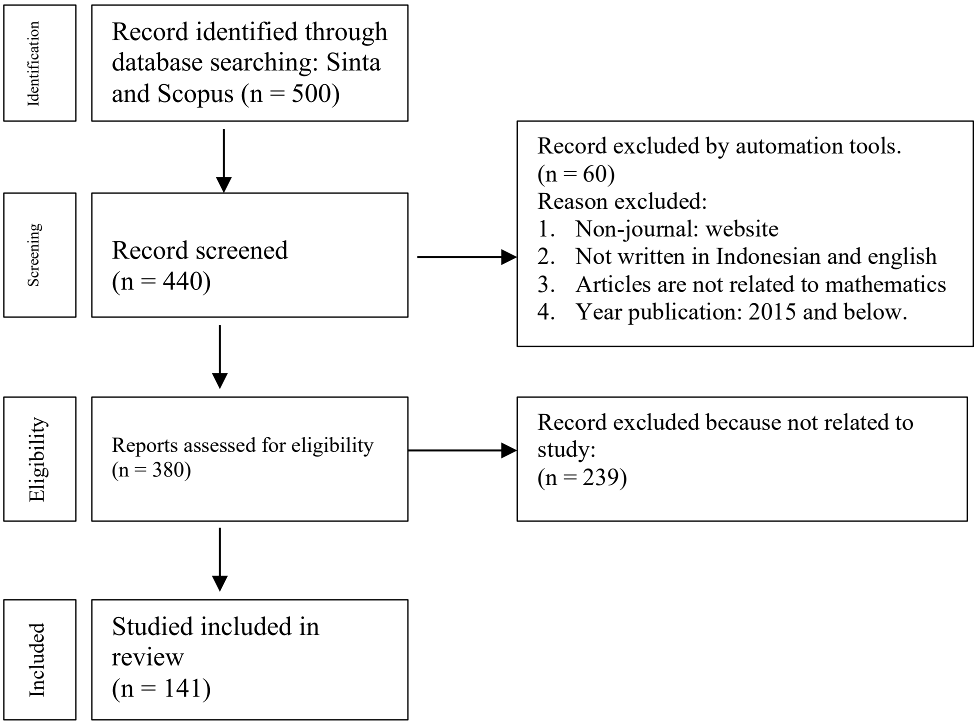

Figure 1. Flow Diagram PRISMA

Based on Figure 1, in the identification stage using the keywords "Australian curriculum" AND "Indonesia curriculum" AND "mathematics learning" AND "primary school" OR "secondary school" in the Sinta and Scopus databases, initially identified 500 studies including books, official documents, articles from journals, official documents, and proceedings articles. Furthermore, in the screening stage, 60 studies in the form of websites, studies unrelated to the mathematics curriculum in Indonesia and Australia, not in Indonesian or English, and published before 2015 were eliminated. Thus, the articles included in this stage are articles published in the Sinta and Scopus databases. Then, in the feasibility stage, 380 studies were obtained. Furthermore, in the final inclusion stage, the author excluded 239 studies that were not relevant to the research. Thus, 141 reference components were identified that met all inclusion criteria for analysis in this systematic literature review.

The data analysis method in this study was carried out through various study reports in the form of proceedings, books, official documents, and various research articles in a descriptive qualitative manner. Narratively focused data analysis was carried out to explore the historical and social background of the development of the mathematics curriculum in both countries so that the unique characteristics of each curriculum and how they are influenced by culture and educational policies were obtained, then narratively and comparatively a comparison will be obtained between the mathematics curriculum in Indonesia and Australia at the junior high school level reviewed from the aspects of objectives, materials, methods and assessments so that a comparative comparison of both of them is obtained against the learning outcomes of the implementation of the mathematics curriculum in both countries.

3. RESULTS AND DISCUSSION

3.1. Mathematics Curriculum in Indonesia and Australia (Objective Component)

Based on the results of the study conducted, it can be seen that education is one of the important needs in life in order to develop human potential [38] so that it is related to the curriculum which is used as a reference in the process of teaching and learning activities to achieve educational goals [39]. Furthermore, based on the main curriculum components, the curriculum objectives in Indonesia, specifically mathematics, have learning objectives that are useful for guiding teaching and learning activities in mathematics. With directed teaching and learning activities, educators are able to reform learning by designing an engaging, enjoyable, and meaningful learning flow that remains aligned with the curriculum objectives, particularly in mathematics [35], [40].

The objectives of mathematics learning in Indonesia (as in Figure 2) are more focused on understanding the material which includes facts, concepts, principles, operations, and mathematical relations and being able to apply this understanding in solving problems appropriately, flexibly, accurately, and efficiently in learning [41], [42]. Mathematical understanding and procedural skills are important things that students in Indonesia must learn [43]. Most of the objectives of mathematics learning in Indonesia emphasize the principle that students must be able to solve problems mathematically that are related to everyday life and be able to solve them correctly [44]. Students in Indonesia in mathematics learning are also emphasized to be able to reason and prove mathematically, both in patterns and characteristics that develop the profile of Pancasila students [45], [46].

B. Objectives

The Mathematics subject aims to equip students with the following skills:

1. to understand mathematical learning materials in the form of mathematical facts, concepts, principles, operations, and relations and to apply them flexibly, accurately, efficiently, and appropriately in solving mathematical problems (mathematical understanding and procedural skills);
2. to use reasoning on patterns and properties, to perform mathematical manipulations to make generalizations, construct proofs, or explain mathematical ideas and statements (mathematical reasoning and proof);
3. to solve problems, including the ability to understand problems, design mathematical models, solve models, or interpret the solutions obtained (mathematical problem solving);
4. communicating ideas using symbols, tables, diagrams, or other media to clarify situations or problems, and presenting a situation in mathematical symbols or models (mathematical communication and representation),
5. relating mathematical learning materials in the form of facts, concepts, principles, operations, and mathematical relations to a field of study, across fields of study, across disciplines, and with life (mathematical connections), and
6. appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as being creative, patient, independent, diligent, open, resilient, tenacious, and confident in problem-solving (mathematical disposition).

Figure 2. Objectives of Mathematics Subjects in the Independent Curriculum

Apart from Indonesia, the objective components in the Australian mathematics curriculum also have objectives in mathematics learning (as in Figure 3) which include: students being able to be speakers and being able to use mathematical concepts effectively, proficiently and confidently [29] who can observe, present, and interpret situations in life and work, think critically, and be able to make decisions as active citizens; develop skills with mathematical processes, procedures, skills, and concepts and use them to demonstrate their expertise in mathematics such as modeling and solving problems, and thinking with numbers, algebra, measurement, geometric shapes, statistics, and probability; make connections between the scope of mathematics and applied mathematics to model situations in various fields and disciplines; develop a positive attitude toward mathematics, recognizing it as a useful field of study; and acquire more specific mathematical knowledge and skills that support the development of numeracy and direct further fields of study in mathematics and other disciplines.

acara OFFICIAL Australian Curriculum

Aims

Mathematics aims to ensure that students:

- become confident, proficient and effective users and communicators of mathematics, who can investigate, represent and interpret situations in their personal and work lives, think critically, and make choices as active, engaged, numerate citizens
- develop proficiency with mathematical concepts, skills, procedures and processes, and use them to demonstrate mastery in mathematics as they pose and solve problems, and reason with number, algebra, measurement, space, statistics and probability
- make connections between areas of mathematics and apply mathematics to model situations in various fields and disciplines
- foster a positive disposition towards mathematics, recognising it as an accessible and useful discipline to study
- acquire specialist mathematical knowledge and skills that underpin numeracy development and lead to further study in mathematics and other disciplines.

Figure 3. Data on the Mathematics Subject Objectives of the Australian Curriculum Version 9.0

Students in Australia are emphasized in learning mathematics to be able to develop their understanding, fluency, reasoning and problem-solving skills which will later be used in everyday life [47], [48]. In addition, developing students' increasingly critical understanding and having strong reasoning in solving problems efficiently will help students in making and taking the right decisions [49], [50]. Students are also required to be able to independently identify mathematical problems encountered in everyday life, then seek solutions and solve the mathematical problems associated with their lives. This is also evident in the implementation of the STEM approach in the Australian curriculum, which aims to create innovative, creative, and enjoyable learning, enabling students to explore their deeper potential, such as improving their creative thinking skills in understanding mathematical material [51], so this indicates that students are more emphasized in being able to develop skills with processes, skill procedures, and mathematical concepts and using them to demonstrate their skills in the field of mathematics.

Based on the mathematics learning objectives in both countries, Indonesia and Australia share similarities in their mathematics learning objectives, namely that students are emphasized on being able to solve mathematical problems related to everyday life and be able to solve them correctly. In Australia, students are more emphasized on being able to develop skills with mathematical processes, procedures, skills, and concepts and use them to demonstrate their expertise in mathematics such as modeling and solving problems, and thinking with numbers, algebra, measurement, geometric shapes, statistics, and probability. Students are also emphasized on being able to develop a positive attitude towards mathematics by recognizing it as a useful field of study. Meanwhile, in Indonesia, the majority of students in Indonesia have negative thoughts and views about mathematics. This is one of the reasons why mathematics is a subject that is disliked and difficult to understand by most students in Indonesia [52].

3.2. Mathematics Curriculum in Indonesia and Australia (Content/Material Components)

Furthermore, based on a review of the content components as one of the components related to the curriculum and material that will be studied by students [53], various policies are provided by the government to make it easier for educators to prepare material for implementing the Merdeka Belajar curriculum, especially within the framework of the mathematics education curriculum. Therefore, educators are given the freedom to choose the pattern/structure of material and experiences for enjoyable learning in every mathematics learning process in the classroom. The mathematics material content in the Merdeka Belajar curriculum focuses more on numeracy literacy, character development, competency-based and flexible [54]. Educators can also adapt to students' understanding of the material and problem-solving skills based on their abilities. Furthermore, students are given the space to explore their skills from a variety of sources and situations, which they can then apply to their daily lives [55].

The learning process does not occur in a rush to complete the material content, but provides students with the opportunity to develop deeper thoughts related to the teaching material that has been delivered by the educator [56], Therefore, in Indonesia, in the Merdeka Belajar curriculum, phase D is the phase at the Junior High School (SMP) level, generally from grades 7 to 9. Each element contains competencies that must be achieved by students, known as learning outcomes, where these learning outcomes are arranged in each phase. In phase D, learning outcomes explain the knowledge, attitudes, and skills to achieve, strengthen, and improve student competencies (as shown in Table 2, which is detailed based on the cognitive abilities to be achieved). The scope of material in each subject is arranged based on the competency level to achieve the minimum graduate competency at the level and form of education. Therefore, the scope of mathematics studied in schools is adjusted to the competencies that must be achieved by students, while still paying attention to the level of depth of the material, the basis of the material, and its use in everyday life [57].

Table 2. Mathematics Learning Outcomes in Phase D of the Independent Learning Curriculum

Learning Outcome	Content Elements
Number	By the end of Phase D, students can read, write, and compare integers, rational and irrational numbers, decimals, exponents and roots, and numbers in scientific notation. They can apply arithmetic operations to real numbers and provide estimates to solve problems (including those related to financial literacy). Students can use prime factorization and the concept of ratio (scale, proportion, and rate of change) in problem solving.
Algebra	At the end of phase D, students can recognize, predict, and generalize patterns in the form of arrangements of objects and numbers. They can express a situation in algebraic form. They can use the properties of operations (commutative, associative, and distributive) to produce equivalent algebraic forms. Students can understand relations and functions (domain, codomain, range) and present them in arrow diagrams, tables, sets of ordered pairs, and graphs. They can distinguish several nonlinear functions from linear functions graphically. They can

Learning Outcome	Content Elements
	solve linear equations and inequalities in one variable. They can present, analyze, and solve problems using relations, functions, and linear equations. They can solve systems of linear equations in two variables using various problem-solving methods.
Measurement	At the end of Phase D, students can explain how to determine the area of a circle and solve related problems. They can explain how to determine the surface area and volume of geometric shapes (prisms, cylinders, spheres, pyramids, and cones) and solve related problems. They can explain the effect of proportional changes in geometric shapes and geometric shapes on length, angle, area, and/or volume.
Geometry	At the end of Phase D, students can create nets for geometric shapes (prisms, cylinders, pyramids, and cones) and construct these shapes from their nets. Students can use the relationships between angles formed by two intersecting lines and by two parallel lines cut by a transversal to solve problems (including determining the sum of the angles in a triangle and determining the measure of an unknown angle in a triangle). They can explain the properties of congruence and similarity in triangles and quadrilaterals and use them to solve problems. They can demonstrate the validity of the Pythagorean theorem and use it to solve problems (including the distance between two points on a Cartesian coordinate plane). Students can perform single transformations (reflection, translation, rotation, and dilation) of points, lines, and geometric shapes on a Cartesian coordinate plane and use them to solve problems.
Data Analysis and Probability	By the end of Phase D, students can formulate questions, collect, present, and analyze data to answer them. They can use bar charts and pie charts to present and interpret data. They can take a representative sample of a population to obtain data related to themselves and their environment. They can determine and interpret the mean, median, mode, and range of the data to solve problems (including comparing a set of data against a group, comparing two sets of data, making predictions, and making decisions). They can investigate the possibility of changes in the central measurement due to changes in the data. Students can explain and use the concepts of probability and relative frequency to determine the expected frequency of an event in a simple experiment (where all outcomes are equally likely to occur).

Meanwhile, in Australia, from year 7 to year 10 (junior high school), there are six content areas for mathematics: number, algebra, measurement, geometric shapes, statistics, and probability, supported by elaborations and achievement standards for each content element (as shown in Table 3 below). Each content element has different achievement levels each year, for example, from year 7 to year 10, there are different achievement levels for each content element. Each elaboration/sub-element has a deeper depth of material, as seen from the achievement standards or learning outcomes at each level. Mathematics uses three content descriptions: number and algebra, measurement and geometric shapes, statistics and probability, to describe the knowledge, skills, and processes applied in the learning process. Of the six content elements, students still find the statistical content or elements difficult, as seen from research results with the help of the StatSmart project. [29], [58].

Table 3. Mathematics Learning Outcomes for Years 7 to 10 of the Australian Curriculum

Year	Learning Outcomes
7^{th} year	By the end of Year 7, students represent natural numbers extensively and as products of prime factors, using exponential notation. Students solve problems involving squares and square roots of perfect squares. Students solve problems involving addition and subtraction of whole numbers. They use the four operations in calculating fractions and decimals, choosing efficient calculation strategies. Students choose equivalent representations of rational numbers and percentages in calculations. They use mathematical models to solve practical problems involving rational numbers, percentages, and ratios in financial and other contexts, justifying their choices of representations. Students use algebraic forms to represent situations, describing relationships between variables from authentic data and substitute values in formulas to determine unknown values. They solve linear equations with natural number solutions. Students create tables of values related to algebraic forms and formulas, and describe the effects of variation.

Year	Learning Outcomes
	Students apply knowledge of angle relationships and angle sums in triangles to solve problems and provide reasoning. They use volume formulas for triangles, parallelograms, rectangles, and triangular prisms to solve problems. They describe the relationship between the radius, diameter, and circumference of a circle. Students classify polygons based on their features and create algorithms to form classified shapes. They represent two-dimensional objects in two ways, describing the benefits of these representations. They use coordinates to describe the transformation of points in the plane. Students plan and conduct statistical investigations involving discrete and continuous numerical data using appropriate displays. They interpret data in terms of shape distributions and statistical inferences, identifying probabilities. Students decide which measure of central tendency is most appropriate and explain their reasoning. They list examples of geometric shapes for a simple experimental step, determine the probability of occurrence, and predict the frequency of corresponding events. Students create a simple, repeatable experiment and run a simulation using digital tools, justifying differences between observed and predicted results.
8th year	By the end of Year 8, students are familiar with irrational numbers, terminating decimals, and repeating decimals. They apply the laws of exponents to calculate numbers related to positive integer exponents. Students solve problems involving the four operations with integers and positive irrational numbers. They use mathematical models to solve practical problems involving ratios, percentages, and values in measurement and financial contexts. Students apply algebraic concepts to rearrange, expand, and factor linear equations. They establish linear relationships and solve linear equations with rational solutions and equations in one variable, graphically and algebraically. Students use mathematical models to solve problems involving linear relationships, interpreting and reviewing the models or examples in appropriate contexts. They make and test conjectures involving linear relationships using digital tools. Students use appropriate matrix units when solving measurement problems involving the perimeter and area of composite figures and the volume of prisms. They use the Pythagorean theorem to solve measurement problems involving right triangles with unknown lengths. Students use formulas to solve problems involving the area and circumference of circles. They solve problems involving duration involving 12-hour and 24-hour time zones in time zones. Students use 3D to locate and describe positions. They identify conditions for congruence and similarity in plane figures, and create and test algorithms designed to test for congruence and similarity. They apply rectangular materials to solve problems. Students conduct statistical investigations and explain the implications of data from samples. They analyze and describe data distributions. They compare variations in random sample distributions of the same size and different sizes from populations given appropriate shapes, measuring central tendency and distance. Students represent two possible combinations with tables and diagrams, considering the associated probabilities to solve practical problems. They conduct experiments and simulations using digital tools to determine the associated probabilities of mixed events.
9th year	By the end of Year 9, students recognize and use rational and irrational numbers to solve problems. They extend and apply the laws of exponents with positive integer variables. Students expand binomial products and factor monic quadratic expressions. They find the distance between two points on a Cartesian plane, and the slope and midpoint of a line segment. Students use mathematical modeling to solve problems involving financial changes and other applied contexts, choosing to use linear and quadratic functions. They graph quadratic functions and solve monic quadratic equations with integer roots algebraically. Students describe the effects of varying parameters on functions and relations, using digital tools, and establish connections between their graphical and algebraic representations. Students apply formulas to solve problems involving the surface area and volume of right prisms and cylinders. They solve problems involving ratio, similarity, and scale in two-dimensional situations. They determine the percentage error in measurements. Students apply the Pythagorean theorem and use trigonometric ratios to solve problems involving right triangles. They use mathematical modeling to solve practical problems involving direct proportions, ratios, and scales, evaluate models, and communicate their

Year	Learning Outcomes
	methods and findings. Students express small and large numbers in scientific notation. They apply magnification transformations to drawings of shapes and objects, and interpret the results. They design, use, and test algorithms based on geometric constructions or theorems. Students compare and analyze the distributions of several numerical data sets, choose representations, describe features of these data sets using summary statistics and distribution shapes, and consider the effects of outliers. They explain how sampling and representation techniques can be used to support or question conclusions or to promote a point of view. They define a set of outcomes for compound events and represent them in various ways. Students assign probabilities to outcomes of compound events. They design and conduct experiments or simulations for compound events using digital tools.
10th year	By the end of Year 10, students recognize the approximate effects of real numbers in repeated calculations. They use mathematical modeling to solve problems involving growth and decay in financial and other applied situations, applying appropriate linear, quadratic, and exponential functions, and solving related equations numerically and graphically. Students generate and test conjectures involving functions and relations using digital tools. They solve problems involving linear equations and linear inequalities in two variables graphically and justify solutions. Students interpret and use logarithmic scales to represent small or large quantities or changes in applied contexts. They solve measurement problems involving the surface area and volume of composite objects. Students apply the Pythagorean theorem and trigonometry to solve practical problems involving right triangles. They identify the impact of measurement errors on the accuracy of results. Students use mathematical modeling to solve practical problems involving proportions, evaluate and modify models, and report assumptions, methods, and findings. They use deductive reasoning, theorems, and algorithms to solve spatial problems. They interpret networks used to represent practical situations and illustrate interconnectedness. Students plan and conduct statistical investigations involving bivariate data. They represent data distributions involving two variables using tables and comment on possible associations. They analyze inferences and conclusions in the media, noting potential sources of bias. Students compare these distributions with continuous numerical data using a variety of displays and discuss distributions in terms of center, spread, shape, and outliers. They apply conditional probability to solve problems involving compound events. Students design and conduct simulations involving conditional probability using digital tools.

Regarding the mathematics content/material taught in both countries, Indonesia and Australia share both similarities and differences. The similarities in the content elements between the two countries are that they both share elements of number, algebra, measurement, and probability. The differences between the two countries are that Indonesia includes geometry and data analysis, while Australia includes elements of geometric shapes and statistics. Although geometric shapes are part of geometry and data analysis is part of statistics, each element has different sub-elements/elaborations, and the learning outcomes in both countries have different achievement standards. Indonesian students in the Merdeka Belajar curriculum only learn basic/essential material for each content element, in contrast to Australian students, who have in-depth material for each content element. Furthermore, in Indonesia, students in phase D still find the material or content elements of data analysis and probability difficult because they are required to be able to understand various sub-materials including diagrams, be able to determine which diagrams are appropriate to the problem, and are required to be able to analyze data related to centralization and distribution of data. Meanwhile in Australia, students still find statistical content material or elements difficult as seen from research results with the help of the StatSmart project.

3.3. Mathematics Curriculum in Indonesia and Australia (Assessment Components)

Based on the assessment components seen from the results of the development of student learning outcomes and as a reference for improving the curriculum for learning progress [59]. In Indonesia, assessment principles in mathematics learning are designed to consider student development and achievement, reflecting diverse student characteristics and adapting to their learning needs, ensuring meaningful and enjoyable learning. Mathematics learning is tailored to student achievement, serving as a benchmark for measuring students' levels of achievement and abilities in mathematics [60], [61]. Learning outcomes in the mathematics curriculum itself include knowledge, skills, and attitudes which are arranged as a continuous process unit so as to form complete competencies of a subject in each phase.

Assessment in the Merdeka Belajar curriculum includes three types of student learning outcomes: diagnostic assessment, formative assessment, and summative assessment. Educators use diagnostic assessment as a basis for planning learning activities according to students' characteristics and learning needs [62]. This can be seen from the results of the diagnostic assessment which is actually used to find students' strengths and weaknesses in the learning process, where the results will later be used as a reference for planning learning that is appropriate to the students' characteristics [63], [64]. Summative assessment can be carried out at the end of the semester, the end of the academic year, and the end of the level [65]. Formative assessment helps educators evaluate the learning process that has taken place so that in the future teachers can plan better and more appropriate learning for students [66], [67]. Regarding the results of the three assessments, educators communicate with students and parents during the learning process intensively, transparently, and personally.

Meanwhile, in Australia, state and territory curriculum, assessment, and certification authorities are responsible for determining how the Australian Curriculum content and achievement standards will be integrated into each educational unit. State and territory authorities also determine assessment specifications. There are several assessments in the Australian Curriculum, namely formative assessment, summative assessment, diagnostic assessment, Curriculum-Based Assessment (CBA), Curriculum-Based Measurement (CBM), portfolio assessment, continuous assessment, peer assessment, and self-assessment. However, the most frequently used to measure student learning outcomes are summative assessment and formative assessment. Of the several types of assessments mentioned above, states and territories also have the authority to determine assessment specifications in each educational unit, referring to the national curriculum. In addition, there is a national assessment aimed at evaluating the quality of learning in each school, namely the National Assessment Program – Literacy and Numeracy (NAPLAN), which is carried out by students in years 7 and 9 at the junior high school level.

3.4. Comparison of Mathematics Curriculum in Indonesia and Australia

Similarities in Mathematics Curriculum in Indonesia and Australia

The mathematics curricula in Indonesia and Australia share many similarities in terms of objectives, materials, and assessment. The following are similarities between the Indonesian and Australian mathematics curricula in terms of objectives, materials, and assessment, as presented in Table 4.

Table 4. Similarities in Mathematics Curriculum in Indonesia and Australia

Numb	Aspect	Mathematics Curriculum in Indonesia	Mathematics Curriculum in Australia
1.	Outcome	Students are encouraged to be able to solve mathematical problems related to everyday life and to be able to solve them correctly. Students in Indonesia are also emphasized in mathematics learning to be able to reason and prove mathematically, both in patterns and properties. Students are also taught how to have an attitude of appreciation for the use of mathematics in everyday life, such as curiosity, attention, interest in learning mathematics, and an attitude of confidence in solving a problem. In addition, students are expected to have behaviors and attitudes that are creative, patient, independent, diligent, open, resilient, tenacious, and confident in solving a problem.	Students develop understanding, reasoning, and proficiency with mathematical processes, procedures, skills, and concepts and use them to demonstrate their mathematical skills such as modeling and problem solving. Students are encouraged to be able to solve mathematical problems related to everyday life and to be able to solve them correctly. The scope of mathematics learning shapes students' mindsets and potential in solving mathematical problems by relating them to everyday life. Students become speakers and can use mathematical concepts effectively, proficiently, and confidently who can observe, present, and interpret situations in life and work, think critically, and are able to make decisions as active citizens.
2.	Content	The Independent Learning Curriculum for mathematics presents five content elements. These five content elements cover numbers, algebra, measurement, geometry, and data analysis and probability.	The Australian Curriculum 9.0 covers six content elements in mathematics: number, algebra, measurement, geometric shapes, statistics, and probability.

Numb	Aspect	Mathematics Curriculum in Indonesia	Mathematics Curriculum in Australia
3.	Assessment	There are three common assessments applied in the learning process: formative assessment, summative assessment, and diagnostic assessment. Indonesia has a national assessment, the Minimum Competency Assessment (AKM).	There are three common assessments applied in the learning process: formative assessment, summative assessment, and diagnostic assessment. In Australia, there is a national assessment, the National Assessment Program – Literacy and Numeracy (NAPLAN).

Based on Table 3, the mathematics curricula in Indonesia and Australia share many similarities. First, consider the objectives of the mathematics curriculum. The objectives of the mathematics curriculum in Indonesia and Australia are nearly identical: students are emphasized for being able to solve mathematical problems related to everyday life and be able to solve them correctly. The mathematics learning objectives in the *Merdeka Belajar* curriculum emphasize students' ability to reason and prove mathematically, both in patterns and properties. Students are also taught how to develop an attitude of appreciation for the usefulness of mathematics in everyday life, such as curiosity, attention, interest in learning mathematics, and confidence in solving problems. Furthermore, students are expected to have behaviors and attitudes that are creative, patient, independent, diligent, open, resilient, tenacious, and confident in solving problems.

The mathematics learning objectives in the Australian Curriculum 9.0 emphasize students to develop understanding, reasoning, and proficiency with mathematical processes, procedures, skills, and concepts and to use them to demonstrate their mathematical skills such as modeling and problem solving. The scope of mathematics learning shapes students' mindsets and potential in solving mathematical problems by relating them to everyday life [68], [69]. Students become speakers and can use mathematical concepts effectively, proficiently, and confidently who can observe, present, and interpret situations in life and work, think critically, and are able to make decisions as active citizens [70], [71].

Second, from a material perspective. In Indonesia, mathematics has five content elements, while in Australia, mathematics has six interconnected content elements. The mathematics content elements in Indonesia and Australia share the same content elements. Third, from an assessment perspective, Indonesia and Australia share the same assessment method for assessing each student's learning outcomes. Both countries utilize three assessments in the learning process: formative assessment, summative assessment, and diagnostic assessment. Furthermore, Indonesia and Australia also have national assessments. Indonesia has the Minimum Competency Assessment (AKM), while Australia has the National Assessment Program – Literacy and Numeracy (NAPLAN).

Differences in Mathematics Curriculum in Indonesia and Australia

In addition to the many similarities between the mathematics curricula in Indonesia and Australia, the two countries also have some differences in terms of objectives, materials, and assessment, although these are not significant. The following are the differences between the Indonesian and Australian mathematics curricula in terms of objectives, materials, and assessment, as presented in Table 5.

Table 5. Differences in Mathematics Curriculum in Indonesia and Australia

Numb	Aspect	Mathematics Curriculum in Indonesia	Mathematics Curriculum in Indonesia
1.	Outcome	Students are expected to have an attitude of appreciating the usefulness of mathematics in life, namely having curiosity, attention, and interest in learning mathematics, as well as a creative, patient, independent, diligent, open, resilient, tenacious, and confident attitude in solving problems. Developing the profile of Pancasila students.	Students are encouraged to develop a positive attitude toward mathematics by recognizing it as a rewarding field of study. Students become speakers and gain more specific mathematical knowledge and skills to support numeracy development and guide further study in mathematics and other disciplines.
2.	Content	The Independent Learning Curriculum for mathematics presents five content elements, with depth extending only to basic/essential material. For example, the algebra content element extends to linear equations.	Australian Curriculum 9.0 presents six content elements in mathematics with greater depth. For example, the algebra content element extends to quadratic equations.
3.	Assessment	Assessments are entirely up to schools and educators to determine assessment	Assessments are entirely up to the states to determine the assessment

Numb	Aspect	Mathematics Curriculum in Indonesia	Mathematics Curriculum in Indonesia
		specifications that adhere to the national curriculum. Furthermore, eighth-grade students will participate in the national assessment in phase D (junior high school/Islamic junior high school).	specifications for each educational unit, based on the national curriculum. Furthermore, students in years 7 and 9 participate in the national assessment at the junior high school (SMP) level.

Based on Table 5, there are no significant differences between the mathematics curricula in Indonesia and Australia. First, consider the objectives of the mathematics curriculum. Although the objectives of the mathematics curriculum in Indonesia and Australia are nearly identical, there are slight differences. The mathematics objectives in the Merdeka Belajar curriculum emphasize students' appreciation of the usefulness of mathematics in everyday life. This requires students to develop curiosity, attention, and interest in learning mathematics, as well as creativity, patience, independence, perseverance, openness, resilience, tenacity, and confidence in problem-solving.

In addition, the Merdeka Belajar curriculum also focuses on building students' potential and character to realize the profile of a Pancasila student, which includes faith, devotion to God Almighty, independence, critical thinking, creativity, mutual cooperation, and a global perspective. Meanwhile, the goal of mathematics learning in the Australian curriculum is for students to become speakers and gain more specific mathematical knowledge and skills to support numeracy development and direct further study in mathematics and other disciplines. Students are also emphasized to be able to develop a positive attitude towards mathematics by recognizing it as a useful field of study. Thus, Australian students are expected to have a positive attitude towards mathematics learning where the mathematical material they have learned is directly connected to everyday life, not just theory, so that students are able to recognize mathematics as a useful field of study.

Second, from a material perspective. In Indonesia, mathematics has five content elements, while in Australia, mathematics has six interrelated content elements. The content elements in the Merdeka Belajar curriculum and the Australian curriculum share the same content elements. These content elements cover numbers, algebra, measurement, geometry, statistics, and probability. However, the two countries differ in the depth of the material. For example, in Indonesia, the algebra content element covers linear equations, while in Australia, the algebra content element covers quadratic equations. In terms of assessment, there are no significant differences between Indonesia and Australia. In Indonesia, assessments are entirely up to schools and educators to determine the assessment specifications, which adhere to the national curriculum. Furthermore, grade 8 students participate in the national assessment at phase D. In Australia, assessments are entirely up to the states to determine the assessment specifications for each educational unit, which adhere to the national curriculum. Furthermore, grade 7 and 9 students participate in the national assessment at the junior high school level. Therefore, the only difference between the two countries is that assessments are directly up to educational units and educators in Indonesia, while assessments are directly up to the states. Furthermore, the national assessment at the junior high school level in Indonesia is represented by only one grade level, grade 8. Australia, on the other hand, has two grade levels, grade 7 and 9.

4. CONCLUSION

Based on the results of the research and discussion that have been presented, the following conclusions can be drawn regarding the comparison of the mathematics curriculum in Indonesia and Australia at the Junior High School level: (1) the objectives of the mathematics curriculum in Indonesia are that students are able to understand mathematical concepts, have the ability to reason, solve problems and mathematical connections, and have the nature of appreciating the usefulness of mathematics in everyday life. However, the objectives of the mathematics curriculum in Australia are that students become speakers, develop skills, develop positive attitudes towards mathematics, and gain more specific mathematical knowledge and skills to support the development of numeracy and direct further fields of study in mathematics and other disciplines; (2) the components of mathematics material in Indonesia and Australia have the same content elements, namely numbers, algebra, measurement, geometry, statistics, and probability, but only have different levels of material depth. For example, in Indonesia the algebraic content elements reach the material of linear equations, while in Australia the algebraic content elements reach the material of quadratic equations; (3) the assessment components of Indonesia and Australia have three assessments applied in the learning process, namely formative assessment, summative assessment, and diagnostic assessment. Therefore, the mathematics curriculum in Indonesia and Australia at the junior high school level is almost the same, with a slight difference: the Indonesian Merdeka Belajar curriculum focuses on developing the Pancasila student profile, while the Australian curriculum, students become speakers and focuses on providing more specific mathematical knowledge and skills to support numeracy development and guide further study in mathematics and other disciplines. Therefore, this finding certainly requires follow-up in the future and may include additional aspects or components that researchers have not previously examined to gain a deeper understanding of the comparison of the mathematics curriculum in Indonesia and Australia.

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For research articles with multiple authors, the following is a detailed description of each author's contribution: Conceptualization by author 1, author 3, and author 4; Methodology, author 1, author 2, author 3, and author 4; Software, author 1 and author 5; Validation or Review, author 1, author 2, author 3, and author 4; Supervision and Proofreading, author 1, author 2, author 3, author 4, and author 5; and the last Project Administration, by author 1.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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